

USER DATA MANAGEMENT

P.9

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GSFC CODE 522
RTOP NO. 481-83-01

THE PRIMARY OBJECTIVE OF THIS EFFORT IS TO IDENTIFY, DEVELOP, AND DEMONSTRATE KEY DATA MANAGEMENT TECHNOLOGIES TO SUPPORT USER ACCESS TO SPACE STATION DATA. TO ACCOMPLISH THIS OBJECTIVE, THERE ARE SEVERAL TECHNICAL CHALLENGES WHICH MUST BE ADDRESSED. FIRST IS HOW TO PROVIDE ROUTINE CUSTOMER ACCESS TO HIGH VOLUME, DYNAMIC AND DISTRIBUTED DATA BASES. THIS ACCESS WILL ENCOMPASS THE FUNCTIONS OF MISSION AND PAYLOAD PLANNING AND OPERATIONS, DATA PROCESSING AND ANALYSIS, AND DATA ARCHIVE AND DISTRIBUTION. SECONDLY, THERE MUST BE SOME ANALYSIS OF ARCHITECTURES FOR HANDLING HIGH-VOLUME DATA STREAMS LIKE THOSE EXPECTED FROM THE SPACE STATION. THIS ANALYSIS WILL EXAMINE THE USE OF PACKETIZED VERSUS NON-PACKETIZED DATA FORMATS, MODULAR EXPANSION CAPABILITIES, REAL-TIME VERSUS NON-REAL-TIME DATA PROCESSING, AND THE INTERFACES AND ARCHITECTURE REQUIRED TO SUPPORT TELESCIENCE OPERATIONS. THE TASK WILL ALSO DETERMINE BENCHMARKS OF PERFORMANCE CAPABILITIES FOR TECHNOLOGY OPERATIONS, SUCH AS VARIED DATA BASE STRUCTURES, DATA ACCESS PROCEDURES, DISTRIBUTED DATA BASE DESIGN, AND DATA BASE MACHINES, IN AN END-TO-END ENVIRONMENT.

USER DATA MANAGEMENT

E. CONNELL

OBJECTIVE:

PROTOTYPE AND EVALUATE DATA MANAGEMENT SYSTEM ELEMENT AND ARCHITECTURE OPTIONS FOR USER PAYLOAD
AND SUPPORTING DATA

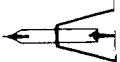
TECHNICAL CHALLENGES:

- PROVIDE EASY-TO-USE, ROUTINE CUSTOMER ACCESS TO HIGH VOLUME, DYNAMIC, GEOGRAPHICALLY
DISTRIBUTED DATA BASES

FUNCTIONS

- MISSION AND PAYLOAD PLANNING & OPS
- DATA PROCESSING AND ANALYSIS
- DATA ARCHIVE AND DISTRIBUTION
 - GROUND AND ONBOARD DATA BASES
 - SCIENCE, ENGINEERING, ANCILLARY DATA
 - CORRELATIVE AND REFERENCE DATA
 - SCHEDULES, MISSION HISTORIES
- ANALYZE ARCHITECTURES FOR HANDLING HIGH-VOLUME DATA STREAMS
 - 100 MBPS AVERAGE THROUGHPUT, 300-600 MBPS PEAK
- DETERMINE REAL BENCHMARKS OF PERFORMANCE CAPABILITIES

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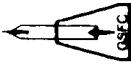


APPROACH

- TEST AND EVALUATE SELECTED DATA MANAGEMENT TECHNOLOGY OPTIONS IN AN END-TO-END ENVIRONMENT
 - DATA BASE STRUCTURES
 - DISTRIBUTED DATA BASE DESIGNS
 - DATA BASE MACHINES
 - DATA ACCESS PROCEDURES
- EVALUATE DISTRIBUTED DATA MANAGEMENT ARCHITECTURE OPTIONS
- EXTEND COMPLETED STUDIES OF HIGH-RATE DATA HANDLING COMPUTERS TO:
 - BENCHMARK PERFORMANCE, IN REAL-WORLD ENVIRONMENT, FOR PACKETIZED AND NON-PACKETIZED FORMATS
 - EXPLORE MODULAR EXPANSION CAPABILITIES (3 → 30 → 300 MBPS THROUHPUT)
 - ASSESS INTERFACES AND ARCHITECTURE REQUIRED TO SUPPORT TELESCIENCE OPERATIONS
 - ANALYZE TECHNOLOGY DRIVERS AND OPTIONS

DELIVERABLES

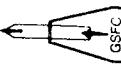
- CONCEPTUAL DESIGN, BENCHMARKS FOR SELECTED DATA MANAGEMENT TECHNOLOGY AND SYSTEM OPTIONS
- ASSESSMENT AND RECOMMENDATIONS FOR APPROACH TO USER DATA MANAGEMENT
- DEFINITION AND EVALUATION OF DATA HANDLING CENTER ARCHITECTURE OPTIONS, INCLUDING BENCHMARK TESTING
- TECHNOLOGY DRIVER OPTIONS ASSESSMENT



STATUS

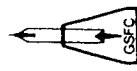
DATA MANAGEMENT

- NOT FEASIBLE TO REPLICATE DATA BASES IN ONE CENTRAL LOCATION
 - TOO MANY
 - TOO LARGE
 - DYNAMIC
 - LIMITED DOWNLINK BANDWIDTH
- NOT REALISTIC TO REQUIRE THAT ALL DATABASES BE STRUCTURED IDENTICALLY
 - WIDELY VARYING REQUIREMENTS
- SCOPE OF SPACE STATION DATA MANAGEMENT PROBLEM MORE LIMITED THAN GENERAL CASE
 - USERS HAVE A GENERAL IDEA OF WHAT THEY NEED
 - IMPLIES LIMITED "BROWSE" REQUIREMENT
 - USERS TYPICALLY REQUEST DATA, BUT DO NOT UPDATE DATABASES
 - LIMITED REMOTE DATABASE MANIPULATION REQUIREMENT
- POTENTIAL SOLUTIONS IN CODE R, T BASE PROGRAMS
 - DATABASE UNIFORMIZATION
 - STANDARD FORMAT DATA UNITS (DATA "SHELL")



STATUS

- AREAS OF UNCERTAINTY
 - "DEPTH" AND UPDATE FREQUENCY OF CENTRAL CATALOG
 - UPLINK TRAFFIC
 - HANDLING OF MULTIPLE USER REQUESTS
 - VIRTUAL CIRCUIT
 - PACKETS
 - PERFORMANCE
 - HARDWARE/SOFTWARE SPEED
 - PHYSICAL LIMITS (E.G., DELAYS DUE TO MULTIPLE SATELLITE HOPS)

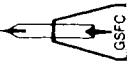


STATUS

HIGH-RATE DATA HANDLING

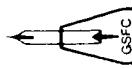
- SPACE STATION PAYLOAD DATA HANDLING REQUIREMENTS ARE A MAJOR CHALLENGE
 - MODULAR GROWTH TO 100 MBPS THROUGHPUT, PEAK RATES 300-600 MBPS
 - DATA THROUGH SYSTEM IN LESS THAN 2 ORBITS (BUT OFTEN MUST BE HELD FOR MORE THAN ONE ORBIT)
 - UP TO 20% OF DATA PROCESSED IN REAL TIME FOR POC'S, SOC'S
- TELESCIENCE OPERATIONS REQUIRE REAL-TIME RECONFIGURATION CAPABILITY TO ACCOMMODATE DIFFERENT INSTRUMENT OPERATING MODES
- "GUARANTEED" DATA DELIVERY MAY REQUIRE SUBSTANTIAL MASS STORE CAPABILITY
 - TRADE: SHORT DATA "HOLD TIME" ⇒ MINIMUM STORAGE COST AT DATA HANDLING CENTER HIGH-SPEED DATA VALIDATION CAPABILITY AT USER FACILITIES USER FACILITIES OPEN AROUND THE CLOCK
 - LONG DATA "HOLD TIME" ⇒ HIGH COST MASS STORE AT DATA HANDLING CENTER LOWER COST DATA VALIDATION AT USER FACILITIES EIGHT HOURS/DAY, FIVE DAYS/WEEK STAFFING AT USER FACILITIES

EXAMPLE: AT 100 MBPS, A 24 HOUR "HOLD" REQUIRES 8.6×10^{12} BITS STORAGE
A 30 HOUR "HOLD" REQUIRES 2.6×10^{14} BITS STORAGE



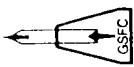
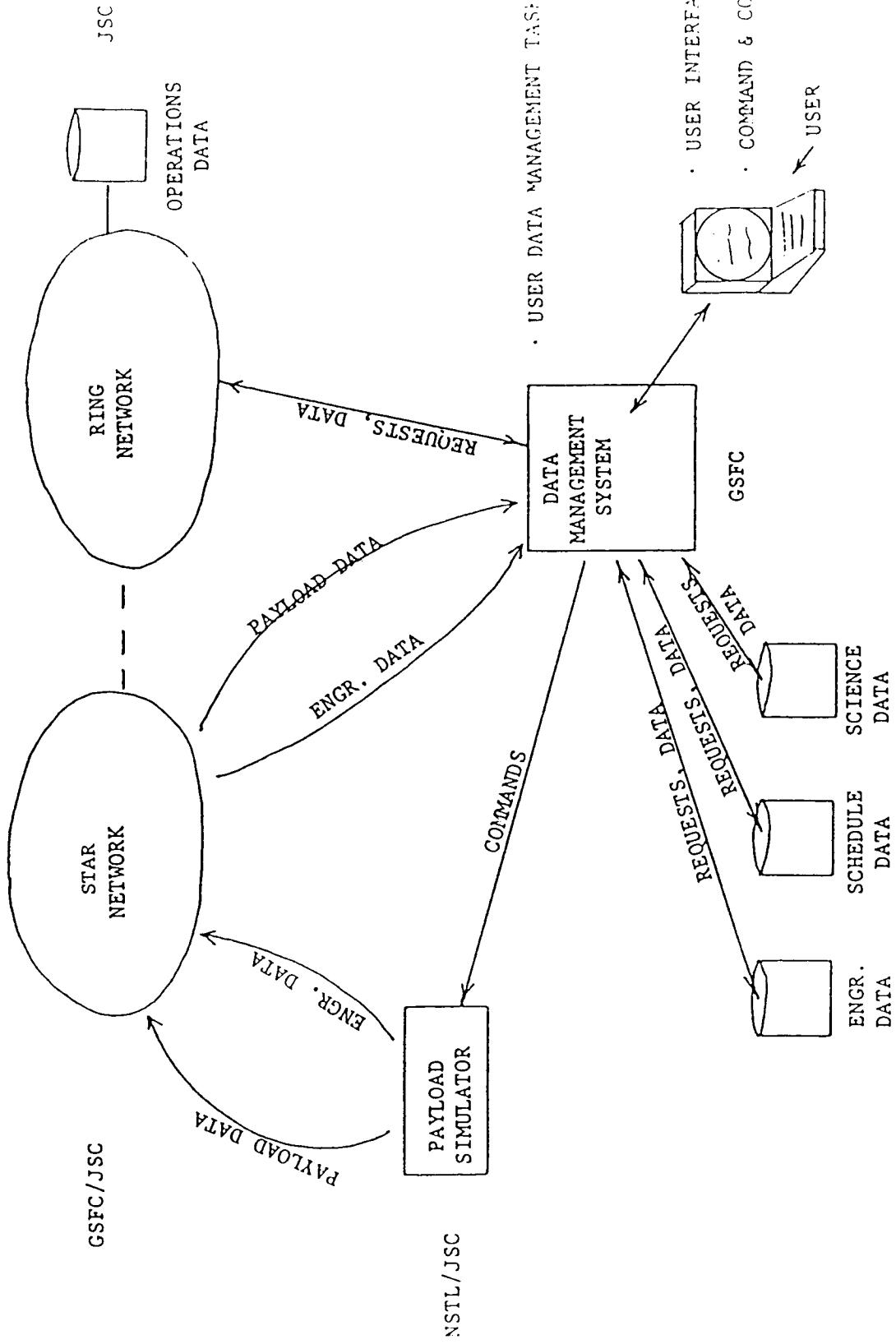
STATUS

- BENCHMARKS ON CDC ADVANCED FLEXIBLE PROCESSOR SHOW CLEAR PERFORMANCE ADVANTAGE FOR PACKETIZED DATA
- 4.1 IMPROVEMENT IN THROUGHPUT WITH PACKETS OVER TDM
- KEY ANALYSIS AREA: PERFORMANCE IMPROVEMENTS OBTAINABLE THROUGH ONBOARD PROCESSING, DATA HANDLING
 - CALIBRATION
 - ANCILLARY DATA MERGING
 - "FORWARD-ONLY" DATA (NO REVERSED TAPE RECORDER DATA)



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FIBER OPTICS NETWORK TASK



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